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(54) Title of the Invention: Nail polish

(57) Summary  
Purpose This invention provides a nail polish which has an excellent film strength, drying rate, and shininess while not causing nails to turn yellow.

Composition This nail polish is characterized by the adoption of a composite, as a film forming agent, described as 20 to 85 percent by weight of styrene and/or methacrylic methyl, 5 to 60 percent by weight of acrylic alkyl ester (whose alkyl chain length is 1 to 8), and 7 to 30 percent by weight of acrylic acid and in which the molecular weight is 10,000 to 70,000.

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**Scope of Patent Claim**

20-85% methyl methacrylate  
or styrene acrylate

5-60% C<sub>1-8</sub> acrylic ester

7-30% acrylic acid

**Claim 1:** Nail polish which is characterized by the adoption of a composite as a film forming agent, described as 20 to 85 percent by weight of styrene and/or methacrylic methyl, 5 to 60 percent by weight of acrylic alkyl ester (whose alkyl chain length is 1 to 8), and 7 to 30 percent by weight of acrylic acid and in which the molecular weight is 10,000 to 70,000.

**Detailed Explanation of the Invention**

**0001**

**Industrial field of usage:** This invention is a nail polish which is characterized by the adoption of a composite as a film forming agent and which contains a specific combination of styrene and/or methacrylic methyl, acrylic ester, and acrylic acid.

**0002**

**Existing technology and the Problem of existing technology:** Nitrocellulose is mostly commonly adopted as the existing technology's film forming agent for nail polishes. In order to improve the aforesaid agent's shininess, adhesion, contraction, plasticity and so on, alkyd resin, alkyl sulfonamide formaldehyde resin, epoxy resin, and rosin denatured resin as well as other chemicals have been combined to the aforesaid agent.

**0003**

Recently, the yellow color change of nails (natural nail color that changes into yellow) which is caused by consecutive usage of nail polish has become a concern. It is thought that one of the reasons for the color change is a xanthoprotein reaction; the ionic nitric acid or ionic nitrous acid that is created when nitrocellulose, when used as the main component of nail polish, is dissolved and combined with a protein, one of the nail's component elements. In addition to the aforesaid problem, the improvement of nail polish components was desired since nitrocellulose is an extremely easy substance to ignite and is very explosive and thus requires careful treatment during storage and delivery as well as during the manufacturing process.

**0004**

In terms of the film strength, water resistance, drying rate, and shininess, and in terms of solving the aforesaid problem, the desired

nail polish cannot be achieved when only alkyd resin, alkyl sulfonamide formaldehyde resin, epoxy resin, and rosin denatured resin are prescribed without nitrocellulose for nail polish.

0005

With these circumstances in mind, the special release 1979-129137 in the Gazette of Publicly Released Patents suggested a new nail enamel characterized by the adoption of a composite as a film forming agent which contains methacrylic ester composites and methacrylic ester and acrylic ester composites. This new nail enamel, however, was not sufficient in terms of the film strength, adhesion, drying rate, and shininess.

0006

The special release 1992-34514 in the Gazette of Publicly Released Patents also suggested a nail polish which combines nail polish with selenium compound alone or with both a selenium compound and an antioxidant which would not cause color changes in nails. Nonetheless, these combinations with selenium compound neither eliminates the cause of the problem nor offers sufficient effects.

0007

The Means of Solving the Problem: As a result of the "blue sky" study which addressed the aforesaid situation, a nail polish which has excellent film strength, drying rate, and shininess properties and which does not cause color changes in nails is realized by adopting a composite, as a film forming agent, which contains styrene and/or methacrylic methyl, acrylic ester, and acrylic acid. Utilizing the aforesaid study, this invention was completed.

0008

In other words, the aforesaid invention relates to nail polish, characterized by the adoption of a composite, as a film forming agent, which contains a specific combination of styrene and/or methacrylic methyl, acrylic ester, acrylic acid.

0009

The specific composite of styrene and/or methacrylic methyl, acrylic ester, and acrylic acid is composed of 20 to 85 percent by weight of styrene and/or methacrylic methyl, 5 to 60 percent by weight of acrylic alkyl ester (whose chain length is 1 to 8), and 7 to 30 percent by weight of acrylic acid and in which the molecular weight is 10,000 to 70,000. Moreover, the character "%" in the following descriptions

is defined as percent by weight unless otherwise indicated.

0010

The composite would lose film flexibility and would become easy to peel off when dry if styrene and/or methacrylic methyl exceeds 85% of the composite. The composite would lack film strength and water resistance if styrene and/or methacrylic methyl is less than 20% of the composite. Although the total amount of styrene and methacrylic methyl should be in the range of 20 to 85%, no problems are realized if only one of these two components are used in the composite.

0011

The composite would lack film strength and the desired drying rate when acrylic ester exceeds 60% of the composite. It would lose the film flexibility and become easy to peel off when dry if acrylic ester is less than 5% of the composite. An acrylic ester that has an alkyl chain length of nine or more is undesirable for nail polish since the aforesaid ester would cause the composite to have difficulty dissolving in a solvent and the given film would easily whiten.

0012

The composite would not provide the desired water resistance when the acrylic acid component exceeds 30% of the composite. It would lack film strength and the desired drying rate when acrylic acid is less than 7% of the composite.

0013

The composite would lack film strength and the desired drying rate when the composite's molecular weight is less than 10,000. When the molecular weight is more than 70,000, it would become difficult to apply the nail polish to nails because of its paste-like nature.

0014

In the aforesaid invention, one or more composite, obtained by a specific styrene and/or methacrylic methyl, acrylic ester, and acrylic acid combination, can be used together. It is desirable to apply the aforesaid combination in the rate of 5 to 50 percent by weight of the total nail polish weight.

0015

Although it is not necessary for aforesaid invention's nail polish to contain other film forming agents than the composite which is obtained by specific styrene and/or methacrylic methyl, acrylic

ester, and acrylic acid, it is possible to contain alkyd resin, alkyl sulfonamide formaldehyde resin, epoxy resin, rosin denatured resin, and so on in the purpose of adjusting the paste like nature, improving pigment dispersion, or other adjustments.

0016

It is also possible for nail polish of the aforesaid invention to contain such additives, if necessary, as a plasticizer, a pigment, a coloring matter, perfume, a gelator, an ultra-violet ray absorbent agent, an antioxidant, an effective component, a solvent and so on which are contained in standard nail polishes.

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0017

As a plasticizer, for example, citric ester groups, phthalate ester groups, ester phosphate groups, and so on can be used. As a pigment, for example, titanium oxide, iron oxide, mica, mica titanium, FISH PHOSPHORUS FLAKE?, and so on can be used. As a coloring matter, for example, red color number 201, red color number 202, blue color number 1, yellow color number 203, the lake groups of these colors, and so on can be used. As a gelator, for example, organic denatured bentonite groups and others can be used. As an ultra-violet ray absorbent agent, for example, oxybenzene, dibenzoylphenon, PABA derivative, and others can be used. As a solvent, for example, such acetic ester groups as acetic ethyl, acetic butyl, and others; such low level alcohol as n-butyl alcohol, isopropyl alcohol (IPA), and others; such hydrocarbon groups as toluene and others; such ketone groups as acetone and others can be used.

0018

Usage examples: The following is a detailed explanation of the aforesaid invention utilizing usage examples and comparison examples. The aforesaid invention is not limited to the following examples. Moreover, the character "%", in the following examples, is defined as percent by weight unless otherwise indicated.

0019

The film strength test, the water resistance test, the drying rate test, and the sensory test were executed in the following manners.

0020

(The film strength test) We applied the testing material with an applicator onto a glass board with an applicator. It was then dried

at a temperature of 30 C° for 4 hours. By using a pencil scratch machine with the weight set at 300g and with a contact degree of 45°, we measured at what level of hardness the pencil could make a scratch on the applied film.

0021

(The water resistance test) We applied the testing material onto a glass board with an applicator. The material was applied in a thickness of 80 μm. It was then dried at a temperature of 30 C° for 4 hours, and then soaked in water heated to 40 C° for 1 hour. We observed the degree of the whitening effect on the material and classified the group in which non reversible whitening and/or peeling was observed, X;

the group in which whitening was observed but reversible after the material is let stand, Δ;

and the group which no change was observed, O.

0022

(The drying rate test) We applied the testing material onto a glass board with an applicator. The material was applied in a thickness of 80 μm. We then measured the time when the testing material did not leave a trace of contact at a constant room temperature of 25 C° and a humidity level of 70 C°.

0023

(The sensory test) We had 20 female panelists test the material for 3 consecutive months. We had them evaluate "whether or not a yellow color change was observed on their nails," "whether or not it was easy to apply," and "whether or not the nail polish had a fine finish." We indicated the number of panelists who responded to each question as "no yellow color change," "easy to apply," and "fine finish."

0024

The following is the monomer compositions (%) and molecular weights of the composite, which was used for the aforesaid usage examples, that contain specific styrene and/or methacrylic methyl, acrylic ester, and acrylic acid combinations.

0025

Chart 1

Compositions	Resin 1	Resin 2	Resin 3
Acrylic ethyl			
Acrylic butyl			

Acrylic acid 2 - ethyl HEKISYL?

Acrylic OCTYL?

Acrylic acid

Styrene

Methacrylic methyl

Molecular weight

0026

Usage examples 1 to 3

Various tests were performed on the nail polish of the aforesaid invention and were adjusted as indicated in Chart 2.

0027

Chart 2

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Compositions	Usage example 1	Usage example 2	Usage
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example 3	Usage example 4		
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Resin 1

Resin 2

Resin 3

Citric acetyl tributyl

Acetic butyl

Acetic ethyl

IPA

0028

(The producing method) We prescribed the nail polish of the aforesaid invention by equally dispersing the mixture of the components indicated in Chart 2.

0029

(Compositions)

Nitrocellulose

Alkyd resin

Citric acetyl

Tributyl

Acetic butyl

Acetic ethyl

IPA

(The producing method) We prescribed the nail polish for comparisons by equally dispersing the mixture of the components above.

0030

Chart 3 indicates the results of the following tests; the film strength test, the water resistance test, drying rate test, and the sensory test for the usage examples 1 to 4 and the comparison example 1.

0031

Chart 3

Tests	Usage example 1	Usage example 2	Usage
	Usage example 3	Usage example 4	Comparison example 1

The film strength test

The water resistance test

The drying rate test (minutes)

The sensory test (number of panelists)

No yellow color change was observed

Easy to apply

Fine finish

0032

As indicated in Chart 3, the nail polish of the aforesaid invention bears similar film features to comparison example 1 which contains nitrocellulose, and yet no yellow color change on nails was observed during the sensory test. Moreover, the sensory test for finish resulted in a better evaluation than the one for comparison 1 which contains nitrocellulose.

0033

Comparison examples 2 to 10.

0034

Chart 4

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Compositions Comparison resins

Acrylic ethyl

Acrylic butyl

Acrylic acid 2 - ethyl HEKISYL?

Acrylic OCTYL?

Acrylic NONYL?

Acrylic acid

Styrene

Methacrylic methyl

Molecular weight



0035

We performed various tests on the prescribed nail polishes for comparison by using resins of monomer compositions as indicated in Chart 4 and by using the compositions as indicated in the Chart 5.

0036

Chart 5

Compositions      Comparison example

Comparison resin 1

Comparison resin 2

Comparison resin 3

Comparison resin 4

Comparison resin 5

Comparison resin 6

Comparison resin 7

Comparison resin 8

Comparison resin 9

Citric acetyl tributyl

Acetic butyl

Acetic ethyl

IPA

0037

(The producing method) We prescribed nail polishes for comparison by equally dispersing the mixture of the components as indicated in Chart 5.

0038

Chart 6 indicates the result of the following tests; the film strength test, the water resistance test, drying rate test, and the sensory test for comparison examples 2 to 10.

0039

Chart 6

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Tests              Comparison examples

The film strength test

The water resistance test

The drying rate test (minutes)

The sensory test (number of panelists)

No yellow color change was observed

Easy to apply

## Fine finish

0040

As indicated in Chart 6, comparison example 2 whose resin's molecular weight is light showed a lack of the film strength and an undesirable drying rate. Comparison example 3 whose resin's molecular weight is too heavy is hard to apply because its adhesion level is too great. Comparison example 4 whose resin contains too much acrylic ester showed a lack of the film strength and an undesirable drying rate. Comparison example 5 whose resin contains too little acrylic ester turned out extremely inferior in finish and the film strength test and the water resistance test could not be performed since the film peeled off when dried. Comparison example 6 whose resin contains too much acrylic acid showed inferior water resistance results. Comparison example 7 whose resin contains less acrylic acid turned out to be a little inferior in terms of film strength, drying rate and the finish appearance was not desirable, either. Comparison example 8 whose resin contains too much styrene and/or methacrylic methyl, similar to comparison example 5, peeled when dried, and neither the film strength test nor the water resistance test could be performed. Comparison example 8's finish appearance was not desirable, either. Comparison example 9 whose resin contains less styrene and/or methacrylic methyl showed a lack of the film strength as well as a rather inferior resistance to water.

0041

Usage example 5

We prescribed nail polishes of the aforesaid invention in the following compositions.

(Compositions)

Resin 2

Organic denatured bentonite

Phthalate dibutyl

Toluene

Acetic ethyl

Acetic butyl

IPA

Titanium oxide

Red color number 202

(The producing method) We prescribed nail polishes of the aforesaid invention by equally dispersing the mixture of the components described above.